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POSITIVE PROPENSITY AND NAVY ENLISTMENT

by

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June 1989

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forecasting enlistments. (3) There has been a definite decrease in nationwide positive propensity during the period 1983-1987. (4) There is significant regional variation in the predictive accuracy of the current Navy enlistment model. (5) Residual analysis of positive propensity indicates that much of the variation in propensity is explained by other significant explanatory variables especially local unemployment. The degree to which other factors explain propensity reduces its effectiveness as an explanatory variable in enlistment forecasting models.

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Positive Propensity
and Navy Enlistment

by

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ABSTRACT

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variables especially local unemployment. The degree to which other factors explain propensity reduces its effectiveness as an explanatory variable in enlistment forecasting models.

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I. INTRODUCTION AND OVERVIEW

A. INTRODUCTION

The challenge of manning the fleet has faced sea-faring nations since the dawn of Naval warfare. At one time or another many nations have been forced to take radical measures to meet their maritime manpower requirements. These methods have included the use of slaves, convicts, and random "impressment" of civilians, to mention just a few of the more colorful solutions. Considered unthinkable by today's standards each was a viable strategy in its own era.

Since the adoption of the All-Volunteer-Force (AVF) concept in 1973 the United States Navy has faced the basic problem of manning the fleet in the absence of conscription. The problem is one of limited supply versus growing demand. Even in a country as large and heavily populated as the United States the supply of young men mentally and physically qualified for active Naval service is small when compared to the growing demand for their labor. The U.S. Bureau of the Census projects that there will be a steady decrease in the male youth population through the mid-1990's. [Ref. 1] General Maxwell Thurman, Commander of the U.S. Army Recruiting Command summarized the problem when he noted that: "This competition for these high school

graduates has been keen since the inception of the volunteer Army. Industry seeks smart young men and women for the same reasons we do." [Ref. 2:p. 276] The Navy must compete with private enterprise, higher education, and the other military services for this limited and valuable pool of people.

B. BACKGROUND AND PROBLEMS

In the 1980's the AVF has proven to be a viable concept. The "happy" coincidence of economic recession, high levels of civilian employment, significantly improved military compensation levels, and a shift in public opinion regarding the legitimacy of military service enabled the Navy to meet its goals for "high quality" recruits through fiscal year 1988.

The concept of quality is critical to any examination of recruitment in the 1980's and beyond. Society grows more technologically complex with each passing year. The demand for young men of the higher mental categories who can learn, master, and manipulate this technology drives the whole recruiting equation. The Navy today concentrates its recruiting effort on 17-21 year-old males who have graduated from High School and are classified as I-IIIA by the Armed Forces Qualification Test (AFQT). Studies by Borack [Ref. 3:p. 225] have shown that successful completion of high school doubles the probability that a given recruit will complete his initial enlistment, and that AFQT scores

at or above the median level are a realistic predictor of a recruit's ability to complete the technical training necessary for service in today's fleet.

There has been a marked deterioration in this recruiting trend in the last two years. As early as second quarter fiscal year 1989 both the Navy and Army failed to meet recruiting goals. The factors driving this downtrend are varied and include the following.

1. A decrease in total male youth cohort size. The U.S. Bureau of the Census predicts a steady decline in the size of the male youth cohort through the mid-1990's. [Ref. 1:p. 3]

2. An increase in the percentage of the male youth cohort rated not physically qualified. Acquired Immune Deficiency Syndrome (AIDS) and drug abuse are growing social phenomenon within the U.S. population. Current DoD policy prohibits enlistment of potential recruits who test positive for either the AIDS virus or drug abuse. As both conditions continue to spread through the American youth population the number of males qualified for Naval service could fall below the levels currently predicted by the Census bureau. [Ref.4]

3. An increase in the percentage of the male youth cohort rated not mentally qualified--the percentage of young American males who graduate from high school is steadily declining. The percentage of potential recruits classified I-IIIA based on their scores on the Armed Forces Qualification Test is also on the decline. [Ref.5:p.51]

C. NAVAL RECRUITING COMMAND (CNRC)

To aid in the formulation of recruiting strategy and the formation of tactical recruiting goals the Commander Naval Recruiting Command (CNRC) uses econometric models to forecast the number of future expected enlistments. Based

partially on these estimates CNRC determines the number and distribution of its field recruiters, and the recruit quota assigned to each. Individual Navy Recruiting Stations (NRS) are located in 41 Naval Recruiting Districts (NRD) across the country. These Districts are themselves parts of the six major Naval Recruiting Areas (NRA). Historically, CNRC has been able to accurately forecast enlistments at the national and NRA level only [Ref. 6:p. 7]. Accurate prediction of enlistments at the NRD or NRS level was considered beyond the capability of the models in use. This inability is in part due to a lack of data of sufficient geographic disaggregation. As a result, the dilemma facing CNRC is threefold:

1. CNRC must be able to estimate the number and geographic location of qualified candidates who are qualified and interested in enlisting.

2. CNRC must determine the optimal number of recruiters and geographic distribution of its field recruiting force to maximize the recruiter/candidate contact ratio.

3. CNRC must calculate and assign recruiting quotas to the respective recruiters to generate the optimal number and category of enlistments.

The LOG-LOG enlistment forecasting models currently in use at CNRC [Ref. 7] are designed to predict I-IIIA enlistments based on the variables listed below.

1. Number of recruiters.

2. Level of local unemployment.

3. National or Naval Recruiting Area "A" Cell population.

4. National or Naval Recruiting Area non "A" cell population.

NOTE: [Models for predicting Black and Hispanic enlistments contain another variable which incorporates the percent minority in the population into the model.] Regressions using these variables have proven adequate in predicting enlistments at the national and Naval Recruiting Area levels. The real challenge to CNRC is to refine the models and gain improved estimates of enlistment behavior at the Naval Recruiting District and eventually the Naval Recruiting Station level. When this is accomplished the Navy will be better able to estimate the "target market," which will assist in the efficient distribution of its recruiting assets, and achievement of a larger market-share of the quality manpower available.

D. OVERVIEW

This study examines the process used to estimate the military enlistment behavior of young men and seeks to develop measures to improve the process. Within this context the study focuses on two specific data sets that display potential for enhancing the accuracy of current Navy enlistment estimating models. The data sets are net enlistment contract data and Youth Attitude Tracking Study (YATS) enlistment propensity data. The results of this study indicate that net enlistment contract data is a better

choice for accurate modeling than the gross or total contract alternative used in some earlier studies.

Application of YATS propensity forms the primary focus of this study through the examination of two distinct propensity variables. The first, called the Navy Propensity Index (NPI), is identical in design to that proposed by Huzar [Ref. 6:p. 16] and used by Brose [Ref. 8:p. 10] in previous research on enlistment behavior. It is indeed a true index as it represents local propensity calculated at the Navy Recruiting District (NRD) level divided by the calculated national level propensity and multiplied by 100. The second variable, christened percent positive propensity (PPP), is the percentage of YATS respondents at the NRD level who indicated that they would be likely to join the Navy.

These alternate measures of enlistment propensity are used as independent variables in the current Navy Recruiting Command (CNRC) enlistment model and in subsequent econometric models designed to investigate aspects of the recruiting environment. The results of these Log-Log regressions are then compared on the basis of overall "goodness of fit" and statistical significance.

Both propensity measures (NPI and PPP) are also used to forecast enlistments for 1987 based on net enlistment contract data collected for the years 1983 to 1986. These forecasts are then compared to actual contract data for 1987

and evaluated based on calculated percent error. The NRD-level breakdown of both data and propensity variables permits identification of typical and atypical results at the local level. These local and regional differences are noted and discussed. The performance of the individual models is evaluated with the NPI models compared directly to PPP models, and with a standard non-propensity model. The exact form of these models is discussed in detail in Chapter III.

The value of using measured propensity as an independent variable for forecasting purposes remains conjectural. It is quite possible that variables based on propensity may in fact be measuring phenomenon already explained by other explanatory variables, such as unemployment and the military-to-civilian pay ratio. The degree to which propensity is or is not explained by other variables ultimately determines its value in forecasting enlistments.

This study, therefore, closely examines the correlation between the explanatory variables in the model. In addition, a model is specified and estimated in an attempt to determine whether local economic conditions have a significant direct influence on propensity. An analysis of the residuals of specific regressions utilizing (PPP), which is the more powerful of the two propensity variables, is conducted to determine if propensity is explained by local

economic factors, or whether some component of local propensity is independent of local economic conditions.

A chronological review of related research and relevant literature on the relation of calculated enlistment propensity to enlistment behavior is contained in Chapter II. Chapter III describes the data used in this study and discusses model specification. Chapter IV analyzes the empirical results focusing on a comparison of performance of the selected econometric models. Chapter V contains conclusions and recommendations.

II. LITERATURE REVIEW

A. PIONEERS: POSITIVE PROPENSITY AS A BASIC RESOURCE

In a 1982 study, "Forecasting Enlistment Actions From Intention Information: Validity and Improvements" [Ref. 9], Bruce Orvis employed YATS propensity data to match enlistment intentions with enlistment actions. He discovered that YATS intentions data could be used as a predictor of an individual's future enlistment probability. Orvis also found that many YATS respondents make their enlistment decisions several years after the survey. While the predictive power of YATS intention measures continues up to four years after the respondent answers the survey, YATS data is most reliable within the first 12-18 months immediately following the survey. [Ref. 9:p. 8] In addition, Orvis found that different intention measures appeared to have varying degrees of predictive value. The survey questions dealing with one single service were better predictors than a general military intention measures. For example the specific Navy intention measure predicted Navy enlistments better than the general military measure. [Ref. 9:p. 44]

As he continued his research into the possible uses of YATS propensity data into 1984 [Ref. 10:p. vi], Orvis tested aggregate enlistment forecasting models and determined that

there are significant relationships between regional differences in average level of enlistment propensity and regional differences in actual enlistment rates (per population). Based on his ability to tie the enlistment rate to enlistment propensity he concluded that enlistment propensity information might prove potentially useful in the identification of "target rich" recruiting areas.

In a study published in 1985 [Ref. 11:pp. 1,4], Orvis and Gahart examined both enlistment intentions and actual enlistment decisions. Enlistment rates by intention level were calculated and compared. The factors that separate enlistees from non-enlistees within intention levels were also investigated. Orvis and Gahart found that the short and long-term factors which separate enlistees from non-enlistees within intention levels included:

1. The nature of the work, degree of job security, and potential for further developement are factors which attract to the military nonstudents and high school students not planning on college.

2. Educational benefits and a steady source of income are factors which attract to the military college students and high school students planning college.

The conclusions reached in this study supported those in earlier studies that YATS data was in fact a valuable tool for predicting enlistments and that enlistment decisions are significantly related to enlistment intentions.

A summary of additional conclusions from the Orvis studies examined include:

1. Differences in enlistment rate were observed when grouping was made by intention level. That is, respondents with the strongest intention levels (unaided mention and aided mention) have a 37 percent enlistment rate, while respondents that had only positive enlistment intentions (aided mention only) enlisted at a rate of only 15 percent.

2. Intentions may predict future enlistments better than demographic data alone.

3. The negative intention group contribute a significant percentage of eventual enlistees.

B. APPLICATION: THE SEARCH FOR A USABLE PROPENSITY TOOL

Based in part on the research of Orvis conducted through 1985, a study was conducted at the Naval Postgraduate School by Lt. Christine Huzar in June 1988. Lt. Huzar used YATS data to examine the usefulness of military propensity indices calculated at the NRD level. [Ref. 6:pp. 45,49] Using logit regression techniques with variables borrowed from the Orvis studies she achieved similar results. Huzar's conclusions were that:

1. As age increases the positive propensity to join the military decreases.

2. High school graduates have a lower propensity to enlist and a lower probability of enlisting than non-graduates.

3. The positive propensity of blacks is almost twice as high as non-blacks.

4. Those not currently enrolled in school displayed increased positive propensity.

5. The higher the high School grade point average the lower the positive propensity.

6. The larger the number of math courses completed the lower the positive propensity.

7. The higher the father's educational level the lower the positive propensity.

Following in Huzar's footsteps at the Naval Postgraduate School in late 1988, Lt. Christopher Brose attempted to develop a usable tool from YATS propensity. He conducted a study to determine if enlistment intention data could be used to improve the estimates of the enlistment forecasting model currently in use by the Navy Recruiting Command. [Ref. 8] In the course of his research, he calculated a positive Navy propensity index for each NRD. These propensity indices were added as independent variables to modified versions of CNRC's enlistment forecasting model and the results indicated that the "fit" of the model was indeed slightly improved. In addition, he estimated enlistment probability models using YATS data and the results indicated that the use of YATS background variables (e.g., age, race, high school graduation, father's education) can be helpful in predicting enlistments at the NRD level when included in a logit enlistment probability model. [Ref. 8:p. iii]

This is essentially the jumping off point for the current study. Building on the pioneering work of Orvis and Gahart, guided by the detailed investigations of Huzar, and attempting to interpret and expand the most recent applications proposed by Brose this investigation will attempt to contribute additional insight in the growing field of

research on the relationship between propensity and enlistment.

III. DATA AND METHODOLOGY

A. DISCUSSION OF DATA

The two data sources used in this study are the Net Enlistment Contract file provided the Navy Recruiting Command (Code 223) and the Youth Attitude Tracking Study (YATSII) for the years 1983-1987 produced by the Research Triangle Institute for the Department of Defense.

Net enlistment contract data covered the years 1983-1987 and contains annual observations of each variable listed in Table 3.1 for all 41 Naval Recruiting Districts (NRD). The variables RECRS, UNEMP, MALEPOPA, MALEPOPB, PAYRATIO, MINORITY, and URBAN are all CNRC estimates based on additional data compiled by CNRC at the NRD level.

The two variables containing Net "A" cell and Net non "A" cell contracts are of particular value in this study. All recruit losses prior to arrival at basic training are considered in the compilation of net data. The gross or total contract data used in some earlier studies [Refs. 6,8] ignored contract losses incurred as a result of the Navy's Delayed Entry Program (DEP). An average of 12 percent of recruits are currently lost during this timeframe due to mental, physical, and legal circumstances. [Ref. 12:p. 84]

The net contract data is an improvement over gross contract data since it counts only those recruits who

TABLE 3.1

NET CONTRACT DATA SET VARIABLES

RECRS	=	Projected on-board recruiters
UNEMP	=	Unemployment rate
MALEPOPA	=	Male "A" cell population (Male high school graduates in the I-IIIA AFQT categories)
MALEPOPB	=	Male non "A" cell population (Male high school graduates not in the I-IIIA AFQT categories)
NAMCONA	=	Male "A"cell population
PAYRATIO	=	Military to civilian payratio
MINORITY	=	Percent minority in population
URBAN	=	Percent urban in population
NAMCONC	=	Male non "A"cell contracts (NET)
YEAR	=	Year data collected
NRD	=	Naval Recruiting District

Source: Navy Recruiting Command (Code 223)

actually report for Basic Training. Use of this data with current forecasting models should lower the level of predicted enlistments and prevent overestimation of enlistment contracts. Overestimation can result in misallocation of recruiting resources, establishment of excessive recruiter quotas, and a false sense of security regarding future accession levels.

Enlistment propensity is estimated using YATS II survey data files for the years 1983-1987. YATS II data consist of responses to a 30-minute telephone interview administered to a nationally representative sample of four recruit market groups: young males (aged 16-21), older males (aged 22-24), young females (aged 16-21), and older females (aged 22-24).

Questions included in the survey examine enlistment propensity, intentions, and attitudes toward the military, enlistment incentives, advertising exposure and service images, and information-seeking and recruiter contact. To be included in the YATS II survey, individuals must reside in the continental United States in households or noninstitutional group quarters with a telephone. They must have no prior military service and have completed no more than two years of college. Two questions are used to assess an individual's propensity to enlist; the unaided mention question and the general intention, or aided mention question. The unaided question asks the respondent what he thinks he might be doing for the next few years. If he states that he will be joining the military, he is considered to have an unaided mention of plans for military service. In this study unaided mentions have been restricted to mentions of plans to join the active duty services by using responses to additional questions in the YATS II survey. The general intention question comes later in the interview and asks the respondent specifically about

the likelihood that he will serve in the military; he can reply "definitely," "probably," "probably not," "definitely not." [Ref. 13:p. 2]

For the purposes of this study the total YATS II data set for 1983-1987 was modified as follows:

1. Only males aged 16 to 24 were considered.
2. No distinctions are made within this group based on age.
3. Only high school graduates and currently enrolled high school students who indicated that they would still be enrolled in the twelfth year were included.
4. Only the aided/general intention measure is used to calculate positive propensity in this study.

B. METHODOLOGY

The initial stage of the investigation involved calculations and data set manipulation required to begin the examination of net contract data and the two propensity variables. Percent positive propensity (PPP) and a Navy propensity index (NPI) are calculated by NRD for each year for the period 1983-1987. This calculation is accomplished using weighted YATS II propensity data. This particular method is a significant departure from past propensity research like studies conducted by Huzar and Brose in 1988 which used unweighted propensity totals.

Selection of the weighted data recognizes that the sampling method employed by the YATS II survey creates an automatically weighted sample. [Ref. 14:p. 2] This

technique is designed to satisfy the sampling precision requirements imposed on the creators of the survey and account for deliberate oversampling and undersampling of specific population groups which regularly occurs from year to year with YATS II. These weighted propensity values are merged with the net contract data set described earlier for use as explanatory variables. Additionally, the correlation of all explanatory variables in the net contract data is examined.

The study next examines the relative value of net contract data. Net contract data for the period 1985-1987 is regressed on the current Navy enlistment prediction model and five derivative models displayed individually in Tables 3.2-3.7. The results of these regressions are then available for comparison with the results generated in 1988 by Brose who used gross contract data provided by the Defense Manpower Data Center.

Table 3.2 displays CNRC's current enlistment forecasting model [Ref. 7], which contains no separate propensity variable. This model provides a baseline on which to evaluate the relative performance of models with added variables.

Table 3.3 presents the basic CNRC model with either NPI or PPP added as an explanatory variable. When compared with the output from the basic model, these specifications

TABLE 3.2

BASIC NAVY RECRUITING COMMAND ENLISTMENT PREDICTION MODEL

$$\log C = A + B1 \log RECRS + B2 \log UNEMP + B3 \log MALEPOPA + B4 \log MALEPOPB$$

C	=	Forecast of new enlistments
A	=	Constant
RECRS	=	Onboard recruiters
UNEMP	=	Local unemployment rate
MALEPOPA	=	Male "A" cell population
MALEPOPB	=	Male non "A" cell population

Source: Navy Recruiting Command

TABLE 3.3

BASIC CNRC MODEL WITH NPI OR PPP PROPENSITY VARIABLES

$$\log C = A + B1 \log RECRS + B2 \log UNEMP + B3 \log MALEPOPA + B4 \log MALEPOPB + B5 (\log NPI \text{ or } \log PPP)$$

C	=	Forecast of new contracts
A	=	Constant
RECRS	=	Onboard recruiters
UNEMP	=	Local unemployment rate
MALEPOPA	=	Male "A" cell population
MALEPOPB	=	Male non "A" cell population
NPI	=	Navy Propensity Index
PPP	=	Percent Positive Propensity

Source: Derived from CNRC forecasting model

provide the opportunity to compare the specific effect of NPI and PPP on the "fit" of the baseline CNRC model.

Table 3.4 shows the Combined Population Model. It differs from the basic model in two ways. First the "A" cell and non "A" cell populations are combined to form a single population variable. This particular form was chosen since the study presupposes that neither propensity measure (NPI or PPP) can distinguish between the two populations. The second exception converts the dependent variable to total accessions since the original variable "A" cell contracts has no way to distinguish between the two populations when they are combined.

TABLE 3.4

COMBINED POPULATION MODEL

LOG C = A + B1 LOG RECRS + B2 LOG UNEMP + B3 LOG TOT

C	=	Forecast of new contracts
A	=	Constant
RECRS	=	Onboard recruiters
UNEMP	=	Local unemployment rate
TOT	=	Total of "A" cell and non"A" cell population

Source: Derived from CNRC forecasting model

Table 3.5 illustrates the Combined Population Model with either NPI or PPP added as explanatory variables. When

examined with the output from basic Combined Population Model the NPI and PPP versions provide the opportunity to compare the effects of NPI and PPP against a common baseline.

TABLE 3.5

COMBINED POPULATION MODEL WITH NPI OR PPP

LOG C = A +B1 LOG RECRS + B2 LOG UNEMP + B3 LOG TOT
+ B4 LOG (NPI or PPP)

C	=	Forecast of new contracts
A	=	Constant
RECRS	=	Onboard recruiters
UNEMP	=	Local unemployment rate
TOT	=	Total of "A" cell and non"A" cell population
NPI	=	Navy Propensity Index
PPP	=	Percent Positive Propensity

Source: Derived from CNRC forecasting model

Table 3.6 presents the Enlistment Rate Model. In this model total accessions are divided by total population to create an enlistment rate "Z" for each NRD, which is then used as the dependent variable. The number of onboard recruiters is also divided by total population to create a recruiter density variable "Y." Adjusting enlistments and recruiters for population helps to alleviate potential heteroskedasticity problems.

TABLE 3.6

ENLISTMENT RATE MODEL WITH NPI

LOG Z = A + B1 LOG Y + B2 LOG UNEMP + B3 LOG (NPI or PPP)

Z	=	Total contracts/total population
A	=	Constant
Y	=	On-board recruiters/"A" cell + non "A" cell pops
UNEMP	=	Local unemployment rate
NPI	=	Navy Propensity Index
PPP	=	Percent Positive Propensity

Source: Derived from CNRC forecasting model

Table 3.7 displays the Propensitized Population Model. This model combines the population variable with propensity by multiplying total "A" cell and non "A" cell population by either NPI or PPP. This permits comparison of the effect of the military available population with the effect of the military available population adjusted for propensity.

At this point the study shifts its focus to an examination of the relative effectiveness of NPI and PPP as independent explanatory variables in each of the six models illustrated in Tables 3.2-3.7.

The value of NPI and PPP in actually forecasting enlistments is examined next. Data for the period 1983-1986 is regressed on the basic CNRC prediction model and its NPI and PPP derivatives. Estimated coefficients from these

TABLE 3.7

PROPENSITIZED POPULATION MODEL

$$LOG\ C = A + B1\ LOG\ RECRS + B2\ LOG\ UNEMP + B3\ LOG\ M$$

C	=	Forecast of new contracts
A	=	Constant
RECRS	=	Onboard recruiters
UNEMP	=	Local unemployment rate
M	=	("A" cell pop + non "A" cell pop) x NPI or PPP

Source: Derived from CNRC forecasting model.

regressions are then used to forecast 1987 enlistment contracts by NRD. The forecast values are compared with known 1987 contract numbers at the NRD level. The effect of NPI, PPP, and any interesting regional variation in forecast accuracy is then examined.

The final part of the study involves an analysis of the residuals of percent positive propensity (PPP) from a regression model. PPP is regressed as a dependent variable with local unemployment, the military to civilian payratio, percent urban, and percent minority as the independent variables. These particular independent variables were selected in an attempt to isolate that proportion of propensity that is explained by economic and demographic factors. The remaining (or residual) proportion will be assumed to be attributable to underlying positive attitudes

toward military service. The propensity residuals generated by the regression model are then added to the net contract data set for use as a separate explanatory variable, which represents "true" regional propensity.

The basic CNRC prediction model with propensity added is then regressed on net contract data for 1983-1987. F-tests are conducted to determine whether the three socioeconomic variables--PAYRATIO, URBAN, and MINORTY--are jointly equal to zero. Finally an F-test is conducted to determine whether the propensity residual variable is itself equal to zero.

IV. ANALYSIS OF RESULTS

A. PROPENSITY MEASURES

The first step in the analysis is an examination of the calculated percent positive Navy propensity (PPP) and Navy propensity index (NPI) values. These values are presented by year for the period 1983-1987 in Tables 4.1-4.5. Several characteristics become obvious upon examination. First, the PPP measures reveal an overall downward trend nationwide. With the exception of a single annual upturn in 1985 average PPP decreases steadily through 1987. The five year decrease represents a nationwide loss in positive propensity to enlist in the Navy of 3.6%. Whatever the cause may be for the decline in Navy propensity, it is at the local rather than the national level that the most interesting facts become apparent.

Naval Recruiting Area One (New England) displays PPP levels which are consistently below the national average. This area contains major population centers like Boston, Philadelphia, New York and New Jersey. The linking of low Navy enlistment propensity to low enlistment probability in this area represents a significant planning tool for CNRC's use in both recruiter recruit assignment and recruit quota determination. At the other end of the spectrum in Area

TABLE 4.1

1983 PERCENT POSITIVE NAVY PROPENSITY AND NAVY PROPENSITY INDICES

Navy Recruiting Area/District	% Positive Navy Propensity	Navy Propensity Index	N
Area 1 New England			
Albany	23.48	101.62	83
Boston	22.65	98.05	111
Buffalo	22.33	96.68	87
New York	21.45	92.84	60
Philadelphia	23.13	100.12	93
New Jersey	22.59	97.77	98
Area 3 Southeast			
Montgomery	22.60	97.82	81
Columbia	22.86	98.96	55
Jacksonville	23.20	104.18	83
Atlanta	23.00	99.59	65
Nashville	23.28	100.78	87
Raleigh	23.48	101.65	120
Richmond	22.70	98.24	53
Miami	21.97	95.10	58
Area 4 Northeast			
Harrisburg	23.66	102.43	49
Washington D.C.	23.06	99.43	131
Cleveland	23.19	99.83	134
Columbus	23.91	103.49	150
Pittsburgh	22.76	98.50	80
Michigan	22.61	97.88	172

TABLE 4.1 (CONTINUED)

	% Positive Navy Propensity	Navy Propensity Index	N
Area 5 Midwest			
Glenview	22.39	96.91	99
St. Louis	22.76	98.52	136
Louisville	22.90	99.14	104
Kansas City	23.08	99.92	51
Minneapolis	23.78	102.93	145
Omaha	23.94	103.60	91
Indianapolis	23.76	102.83	104
Milwaukee	22.28	96.45	44
Area 7 Southwest			
Denver	24.10	104.30	49
Albuquerque	22.33	96.65	31
Dallas	23.70	102.57	298
Houston	23.11	100.02	48
Little Rock	22.91	99.17	104
New Orleans	22.87	99.00	107
San Antonio	23.31	100.92	42
Memphis	23.81	103.07	88
Area 8 West			
Los Angeles	21.38	92.54	90
Portland	24.41	105.64	188
San Francisco	23.00	99.56	174
Seattle	24.00	103.91	88
San Diego	22.90	99.10	48
National Average	23.04	99.78	

Source: Developed from the Youth Attitude Tracking Study, 1983

TABLE 4.2

1984 PERCENT POSITIVE NAVY PROPENSITY AND NAVY PROPENSITY INDICES

Navy Recruiting Area/District	% Positive Navy Propensity	Navy Propensity Index	N
Area 1 New England			
Albany	21.41	101.27	83
Boston	20.67	97.77	179
Buffalo	20.06	94.93	63
New York	20.27	95.92	130
Philadelphia	20.95	99.10	122
New Jersey	20.32	96.15	74
Area 3 Southeast			
Montgomery	20.92	98.92	61
Columbia	20.84	98.61	82
Jacksonville	20.68	97.83	72
Atlanta	21.32	100.86	85
Nashville	21.58	102.09	81
Raleigh	21.15	100.07	107
Richmond	21.53	101.86	49
Miami	21.25	100.54	76
Area 4 Northeast			
Harrisburg	21.90	103.63	110
Washington D.C.	21.21	100.34	104
Cleveland	22.26	105.32	113
Columbus	20.97	99.20	124
Pittsburgh	21.26	100.60	59
Michigan	21.86	103.41	152

TABLE 4.2 (CONTINUED)

	% Positive Navy Propensity	Navy Propensity Index	N
Area 5 Midwest			
Glenview	21.21	100.36	158
St. Louis	20.27	95.89	97
Louisville	21.89	103.57	94
Kansas City	21.80	103.12	53
Minneapolis	21.66	102.50	117
Omaha	21.43	101.39	87
Indianapolis	22.32	105.62	100
Milwaukee	21.60	102.20	56
Area 7 Southwest			
Denver	21.49	101.68	62
Albuquerque	20.88	98.77	64
Dallas	21.35	100.99	210
Houston	21.11	99.89	63
Little Rock	21.16	100.13	87
New Orleans	21.07	99.71	93
San Antonio	21.55	101.97	57
Memphis	20.89	98.82	71
Area 8 West			
Los Angeles	20.96	99.19	109
Portland	20.85	98.66	142
San Francisco	20.51	97.02	144
Seattle	21.07	99.68	67
San Diego	20.47	96.84	109
National Average	21.14	100.02	

Source: Developed from the Youth Attitude Tracking Study, 1984

TABLE 4.3

1985 PERCENT POSITIVE NAVY PROPENSITY AND NAVY PROPENSITY INDICES

Navy Recruiting Area/District	% Positive Navy Propensity	Navy Propensity Index	N
Area 1 New England			
Albany	20.73	93.40	150
Boston	22.34	100.59	275
Buffalo	22.51	101.38	71
New York	21.80	98.19	237
Philadelphia	22.22	100.06	83
New Jersey	20.86	93.95	99
Area 3 Southeast			
Montgomery	22.89	103.06	56
Columbia	21.81	98.24	136
Jacksonville	22.50	101.34	184
Atlanta	21.71	97.74	51
Nashville	21.80	98.15	70
Raleigh	22.62	101.86	257
Richmond	22.10	99.54	44
Miami	22.36	100.69	154
Area 4 Northeast			
Harrisburg	22.41	100.93	66
Washington D.C.	22.67	102.09	65
Cleveland	21.66	97.55	97
Columbus	21.24	95.67	117
Pittsburgh	22.36	100.70	73
Michigan	22.25	100.21	96

TABLE 4.3 (CONTINUED)

	% Positive Navy Propensity	Navy Propensity Index	N
Area 5 Midwest			
Glenview	22.64	100.93	232
St. Louis	23.18	104.38	55
Louisville	22.76	102.49	109
Kansas City	21.86	98.46	60
Minneapolis	23.13	104.17	50
Omaha	23.25	104.69	75
Indianapolis	23.61	106.31	69
Milwaukee	22.85	102.91	56
Area 7 Southwest			
Denver	23.23	104.61	44
Albuquerque	21.79	98.61	42
Dallas	22.49	101.26	80
Houston	21.51	96.86	69
Little Rock	22.35	100.66	105
New Orleans	22.20	99.97	89
San Antonio	22.40	100.86	69
Memphis	21.96	98.90	70
Area 8 West			
Los Angeles	21.71	97.78	236
Portland	22.77	102.52	90
San Francisco	21.68	97.61	136
Seattle	22.26	100.25	56
San Diego	20.89	94.06	153
National Average	22.20	99.00	

Source: Developed from the Youth Attitude Tracking Study, 1985

TABLE 4.4

1986 PERCENT POSITIVE NAVY PROPENSITY AND NAVY PROPENSITY INDICES

Navy Recruiting Area/District	% Positive Navy Propensity	Navy Propensity Index	N
Area 1 New England			
Albany	19.37	98.70	152
Boston	19.52	99.42	214
Buffalo	19.54	99.56	77
New York	19.59	99.79	292
Philadelphia	19.56	99.67	48
New Jersey	18.97	96.64	67
Area 3 Southeast			
Montgomery	19.66	100.13	52
Columbia	19.79	100.80	170
Jacksonville	19.78	100.78	188
Atlanta	19.48	99.24	58
Nashville	19.99	101.83	60
Raleigh	19.65	100.08	274
Richmond	19.87	101.24	64
Miami	19.70	100.34	121
Area 4 Northeast			
Harrisburg	19.40	98.84	35
Washington D.C.	19.34	98.51	77
Cleveland	19.68	100.27	41
Columbus	19.73	100.52	92
Pittsburgh	20.17	102.77	37
Michigan	19.75	100.61	80

TABLE 4.4 (CONTINUED)

	% Positive Navy Propensity	Navy Propensity Index	N
Area 5 Midwest			
Glenview	19.81	101.28	272
St. Louis	18.75	95.50	40
Louisville	19.51	99.40	94
Kansas City	19.58	99.74	38
Minneapolis	20.02	102.00	62
Omaha	19.39	98.78	99
Indianapolis	19.77	100.72	106
Milwaukee	19.38	98.75	50
Area 7 Southwest			
Denver	19.61	99.91	61
Albuquerque	19.78	100.79	61
Dallas	20.12	102.48	60
Houston	19.40	98.84	38
Little Rock	19.84	101.05	98
New Orleans	19.40	98.82	94
San Antonio	20.08	102.29	48
Memphis	19.11	97.34	85
Area 8 West			
Los Angeles	19.45	99.09	211
Portland	19.84	101.07	94
San Francisco	19.91	101.42	299
Seattle	19.64	100.07	55
San Diego	19.59	99.78	139
National Average	19.63	100.23	

Source: Developed from the Youth Attitude Tracking Study, 1986

TABLE 4.5

1987 PERCENT POSITIVE NAVY PROPENSITY AND NAVY PROPENSITY INDICES

Navy Recruiting Area/District	% Positive Navy Propensity	Navy Propensity Index	N
Area 1 New England			
Albany	19.40	99.32	172
Boston	19.65	100.59	163
Buffalo	19.45	99.56	125
New York	19.04	97.47	125
Philadelphia	19.27	98.67	84
New Jersey	18.92	96.84	71
Area 3 Southeast			
Montgomery	19.61	100.40	82
Columbia	19.82	101.47	86
Jacksonville	19.91	101.94	93
Atlanta	19.53	99.98	82
Nashville	20.21	103.45	81
Raleigh	19.59	100.30	150
Richmond	19.73	100.98	81
Miami	20.04	102.61	62
Area 4 Northeast			
Harrisburg	19.94	102.07	85
Washington D.C.	19.54	100.04	78
Cleveland	20.08	102.81	87
Columbus	20.06	102.67	171
Pittsburgh	19.45	99.45	103
Michigan	19.33	98.94	135

TABLE 4.5 (CONTINUED)

	% Positive Navy Propensity	Navy Propensity Index	N
Area 5 Midwest			
Glenview	19.51	99.86	143
St. Louis	18.77	96.08	83
Louisville	18.94	96.97	166
Kansas City	19.26	98.59	71
Minneapolis	19.51	99.86	97
Omaha	19.59	100.26	148
Indianapolis	19.58	100.21	72
Milwaukee	19.95	102.12	86
Area 7 Southwest			
Denver	19.43	99.47	45
Albuquerque	19.79	101.31	54
Dallas	19.62	100.46	62
Houston	19.97	102.23	68
Little Rock	19.41	99.37	134
New Orleans	19.55	100.07	112
San Antonio	19.61	100.38	71
Memphis	19.75	101.11	83
Area 8 West			
Los Angeles	19.30	98.81	269
Portland	19.42	99.39	109
San Francisco	19.72	100.97	171
Seattle	19.50	99.83	77
San Diego	19.44	99.52	143
National Average	19.53	100.15	

Source: Developed from the Youth Attitude Tracking Study, 1987

Seven (Southwest) and Area Four (Northeast) propensity is consistently higher than the national average.

At the local level, while no Naval Recruiting Districts (NRD) showed consistently high propensity three NRD's--St. Louis, New Jersey, and New York--were frequently among the lowest. All three of the low propensity NRD's are heavily urban, are home to large minority populations, and suffer from higher than average unemployment. These three socioeconomic factors are normally considered as ideal preconditions for a successful recruiting environment. It seems on the surface that the propensity measured by YATS II in these three NRD's may not be strongly related to these particular socioeconomic indicator variables. The study examines this relationship in much greater detail during the residual analysis section described later in this chapter.

B. CORRELATION TO EXPLANATORY VARIABLES

In order to examine the possible relationships between study variables Pearson correlation coefficients were calculated for all explanatory variables, and displayed in Table 4.6. Examination of Table 4.6 reveals that the variable onboard recruiters has a strong correlation with both "A" cell and non "A" cell contracts and to a lesser degree with the two population variables. The low but still significant negative correlation between recruiters and PPP may be the result of multicolliearity between unemployment

TABLE 4.6

CORRELATION OF EXPLANATORY VARIABLES

	RECRS	UNEMP	MALEPOPA	MALEPOPB	NAMCONA	NAMCONC	NPI	PAYRATIO	URBAN	MINORTY	RESID
RECRS	1.00000	-0.14705	0.77034	0.74327	0.81348	0.83416	-0.31402	-0.09769	0.44311	-0.05225	-0.30035
	0.0000	0.0354	0.0001	0.0001	0.0001	0.0001	0.0001	0.1635	0.0001	0.4568	0.0001
UNEMP	-0.14705	1.00000	-0.07873	0.01668	0.10734	0.06404	0.43936	-0.16055	-0.24680	-0.02359	-0.00000
	0.0354	0.0000	0.2618	0.8124	0.1255	0.3616	0.0001	0.0215	0.0004	0.7371	1.0000
MALEPOPA	0.77034	-0.07873	1.00000	0.77547	0.74285	0.59208	-0.01587	-0.37968	0.50471	-0.21271	-0.01354
	0.0001	0.2618	0.0000	0.0001	0.0001	0.0001	0.8214	0.0001	0.0001	0.0022	0.8472
MALEPOPB	0.74327	0.01668	0.77547	1.00000	0.54890	0.76465	-0.02797	-0.21113	0.47314	0.25965	-0.04452
	0.0001	0.8124	0.0001	0.0000	0.0001	0.0001	0.6905	0.0024	0.0001	0.0002	0.5262
NAMCONA	0.81348	0.10734	0.74285	0.54890	1.00000	0.70051	-0.15194	-0.26929	0.30865	-0.29469	-0.25528
	0.0001	0.1255	0.0001	0.0001	0.0000	0.0001	0.0296	0.0001	0.0001	0.0001	0.0002
NAMCONC	0.83416	0.06404	0.59208	0.76465	0.70051	1.00000	-0.26804	-0.07354	0.32425	0.18003	-0.33503
	0.0001	0.3616	0.0001	0.0001	0.0001	0.0000	0.0001	0.2946	0.0001	0.0098	0.0001
NPI	-0.31402	0.43936	-0.01587	-0.02797	-0.15194	-0.26804	1.00000	-0.08120	-0.08423	-0.05585	0.89631
	0.0001	0.0001	0.8214	0.6905	0.0296	0.0001	0.0000	0.2471	0.2298	0.4264	0.0001
PAYRATIO	-0.09769	-0.16055	-0.37968	-0.21113	-0.26929	-0.07354	-0.08120	1.00000	-0.28113	0.06563	0.00000
	0.1635	0.0215	0.0001	0.0024	0.0001	0.2946	0.2471	0.0000	0.0001	0.3498	1.0000
URBAN	0.44311	-0.24680	0.50471	0.47314	0.30865	0.32425	-0.08423	-0.28113	1.00000	0.26478	-0.00000
	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001	0.2298	0.0001	0.0000	0.0001	1.0000
MINORTY	-0.05225	-0.02359	-0.21271	0.25965	-0.29469	0.18003	-0.05585	0.06563	0.26478	1.00000	-0.00000
	0.4568	0.7371	0.0022	0.0002	0.0001	0.0098	0.4264	0.3498	0.0001	0.0000	1.0000
RESID	-0.30085	-0.00000	-0.01354	-0.04452	-0.25528	-0.33503	0.89631	0.00000	-0.00000	-0.00000	1.00000
RESIDUALS	0.0001	1.0000	0.8472	0.5262	0.0002	0.0001	0.0001	1.0000	1.0000	1.0000	0.0000

Source: SAS correlation matrix output

and PPP. The correlations with "A" cell and non "A" cell contracts represent a logical result of a larger workforce producing greater output.

Still in Table 4.6 the size of the "A" cell population is highly correlated with the non "A" cell population, onboard recruiters, and "A" cell contracts. The high correlation between "A" cell population and non "A" cell population is entirely expected since together they constitute total supply of potential recruits. The correlation between onboard recruiters and "A" cell population is the result of deliberate action by CNRC to concentrate the recruiting force where the population of potential high-quality recruits is largest. Likewise, the higher number of onboard recruiters combined with the larger population accounts for the high correlation with "A" cell contracts. The non "A" cell population displays similar correlation with onboard recruiters, "A" cell population and non "A" cell contracts.

"A" cell contracts are most strongly correlated with onboard recruiters followed in lesser degree by "A" cell population, non "A" cell contracts, and non "A" cell population. Again the correlation between onboard recruiters and "A" cell contracts is most probably explained by recruiter density and the frequency of recruiter contacts with the "A" cell population. Non "A" cell contracts show

similar correlations to onboard recruiters, non "A" cell population, "A" cell contracts, and "A" cell population.

Percent positive propensity is, as expected, most strongly related to the propensity residual variable. In addition, it displays its next strongest correlation to local unemployment and has a modest negative correlation with non "A" cell contracts. The relationship with the propensity residual variable is no doubt the result of its having been derived from PPP figures. The negative correlation between positive propensity and non "A" cell should be explained by the fact that higher propensity means higher levels of "A" cell contracts, which reduce the need for non "A" cell contracts.

The military-to-civilian payratio shows a modest and expected negative correlation with "A" cell contracts indicating that low military wage levels have an unpleasant effect on "A" cell enlistments. Additionally a more modest negative correlation between payratio and percent urban population supports the accepted premise that civilian wage levels are normally higher in urban areas.

The propensity residual variable displays the high correlation with positive propensity discussed before as well as more modest negative correlations with both "A" cell and non "A" cell contracts, and onboard recruiters.

The final explanatory variable, local unemployment, shows moderate positive correlation only positive

propensity, indicating that the level of local unemployment may indeed exert a strong influence on local enlistment propensity.

C. NET AND GROSS CONTRACT DATA

Tables 4.7 and 4.8 display the results of the regression of the Navy Recruiting Command's basic enlistment prediction model on net and gross contract data pooled for the three year period 1985-1987. This generates a total sample size of 123 (41 NRDs x 3 years). Comparison of the adjusted R-square and F-statistic in Table 4.7 to that in Table 4.8 reveals that "fit" improves when the model is used with net vice gross data. This increased precision is all the more welcome when it is considered that: (1) not only does the net data contain information of greater relevance to CNRC (bodies through the door at boot camp as opposed to contract numbers only); and (2) The net data also seems more compatible with the current CNRC model.

D. PPP AND NPI AS EXPLANATORY VARIABLES

Comparison of the results of a regression of CNRC's basic model on net "A" cell contracts for the period 1983-1987 shown in Table 4.9 with models modified to include PPP (Table 4.10) and NPI (Table 4.11) reveals that the inclusion of NPI as an explanatory variable slightly decreases the adjusted R-square from .8245 to .8211. Use of PPP vice NPI results in an increase in adjusted R-square to .8569.

TABLE 4.7

RECRUITING COMMAND MODEL 1985-1987
(DEPENDENT VARIABLE = NET A-CELL CONTRACTS)

Variable	Beta	Std Error	T Value	
INTERCEPT	.9281	.4920	3.918	***
LOGRECRS	.8519	.0601	14.174	
LOGUNEMP	.3613	.0438	8.253	***
LOGMALEPOPA	.1476	.0450	3.278	***
LOGMALEPOPB	- .0835	.0548	-1.524	

F-Value = 146.239
Adjusted R-Square = .8264
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.8

RECRUITING COMMAND MODEL USING GROSS DATA 1985-1987
(DEPENDENT VARIABLE = GROSS A-CELL CONTRACTS)

Variable	Beta	Std Error	T Value	
INTERCEPT	-.2321	.6666	-.348	
LOGRECRS	.5003	.0896	5.579	***
LOGUNEMP	.3687	.0559	6.588	***
LOGMALEPOPA	.5010	.0612	8.180	***
LOGMALEPOPB	-.1253	.0735	-1.703	**

F-Value = 83.304
Adjusted R-Square = .8025
***Significant at the 99% confidence level
** Significant at the 90% confidence level

Source: Brose 1988 [Ref. 8:p. 54]

TABLE 4.9

RECRUITING COMMAND MODEL 1983-1987
(DEPENDENT VARIABLE = NET A-CELL CONTRACTS)

Variable	Beta	Std Error	T Value	
INTERCEPT	2.1409	.4135	5.177	
LOGRCR	.8498	.0535	15.884	***
LOGUNE	.3094	.0331	9.346	***
LOGPOPA	.4073	.0382	10.638	***
LOGPOPB	-.3836	.0476	-8.052	***

F-Value = 232.703
Adjusted R-Square = .8211
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.10

RECRUITING COMMAND MODEL WITH NPI 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	.7157	1.9585	.365	
LOGRCR	.8663	.0529	16.362	***
LOGUNE	.3098	.0332	9.325	***
LOGPOPA	.4097	.0384	10.657	***
LOGPOPB	-.3926	.0474	-8.283	***
LOGNPI	.3105	.4012	.774	

F-Value = 192.258
Adjusted R-Square = .8242
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.11

RECRUITING COMMAND MODEL WITH PPP 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	2.8270	.4456	6.343	
LOGRCR	.8517	.0503	16.902	***
LOGUNE	.3077	.0302	10.160	***
LOGPOPA	.1757	.0339	5.179	***
LOGPOPB	-.1031	.0407	-2.530	**
LOGPPP	-.2961	.1343	-2.204	**

F-Value = 245.300
Adjusted R-Square = .8569
***Significant at the 99% confidence level
** Significant at the 97% confidence level

Source: SAS Regression Output

Additionally, the NPI variable is not statistically significant while PPP is significant at the 97 percent confidence level. However, the coefficient of PPP has a negative sign in Table 4.11. That is, greater NRD propensity is associated with fewer Navy contracts, an unexpected result. This unexpected sign is most probably an artifact of multicollinearity between the propensity variable (PPP) and the local unemployment variable. In addition, the generally small sample sizes available for calculation of PPP at the NRD level may well result in generation of propensity variables of low power and unpredictable sign.

Table 4.12 is a modification of the basic CNRC model which combines "A" cell and non "A" cell population to form a single population variable (LOGTOT). In addition, the dependent variable has been changed to total contracts vice "A" cell contracts. Tables 4.13 and 4.14 represent this combined population model with NPI and PPP added as explanatory variables, respectively. Comparison of the "fit" of these three models reveals that addition of NPI has little or no impact while addition of PPP slightly improves the Adjusted R-square from .8384 to .8399. PPP is statistically significant at the 90 percent confidence level while NPI remains insignificant. Again, however, the sign of PPP is negative and multicollinearity and small sample size remain the most likely culprits.

TABLE 4.12

COMBINED POPULATION MODEL 1985-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	1.9213	.3974	4.835	
LOGRCR	.9090	.0473	19.196	***
LOGUNE	.2625	.0294	8.928	***
LOGTOT	.0506	.0442	1.145	

F-Value = 353.778
Adjusted R-Square = .8384
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.13

COMBINED POPULATION MODEL WITH NPI 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	.2453	1.7645	.139	
LOGRCR	.9116	.0474	19.218	***
LOGUNE	.2608	.0294	8.855	***
LOGTOT	.0550	.0445	1.237	
LOGNPI	.3505	.3595	.975	

F-Value = 265.506
Adjusted R-Square = .8384
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.14

COMBINED POPULATION MODEL WITH PPP 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	2.3801	.4804	4.954	
LOGRCR	.8675	.0532	16.305	***
LOGUNE	.2825	.0315	8.942	***
LOGTOT	.0846	.0484	1.745	***
LOGPPP	-.2381	.1415	-1.683	**

F-Value = 268.459
Adjusted R-Square = .8399
***Significant at the 99% confidence level
** Significant at the 90% confidence level

Source: SAS Regression Output

Tables 4.15 and 4.16 display results of the regression of the enlistment rate modification to CNRC's basic model illustrated earlier in Table 3.5. In this specification

neither NPI nor PPP are statistically significant above the 90 percent confidence level. The recruiter to total population ratio variable (Y) is by far the most influential in both sets of regression results, emphasizing once again the preeminence of onboard recruiters in explaining total contracts.

TABLE 4.15

ENLISTMENT RATE AS THE DEPENDENT VARIABLE WITH NPI 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	-.4110	1.6547	-.248	
LOGY	.9328	.0430	21.654	***
LOGUNE	.2543	.0292	9.025	***
LOGNPI	.4388	.3500	1.254	

F-Value = 169.353
Adjusted R-Square = .7123
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.16

ENLISTMENT RATE AS THE DEPENDENT VARIABLE WITH PPP 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	1.9691	.4042	4.871	
LOGY	.9038	.0480	18.798	***
LOGUNE	.2856	.0316	9.023	***
LOGPPP	-.2053	.1405	-1.461	

F-Value = 170.011
Adjusted R-Square = .7131
***Significant at the 99% confidence level

Source: SAS Regression Output

The same can be said of a comparison of regressions using the propensitized population model illustrated earlier in Table 3.6. Table 4.17 reports results of a regression conducted on net contract data for the three year period 1983-1987 (sample size = 123), where the combined "A" cell and non "A" cell population is multiplied by NPI to form the propensitized population variable (M) and Table 4.18 reports the results of a similar regression conducted where population was multiplied by PPP vice NPI. In both cases the propensitized population variable is not statistically significant above the 90 percent confidence level while onboard recruiters continues to explain the bulk of "A" cell contracts.

TABLE 4.17

TOTAL ACCESSIONS AS THE DEPENDENT VARIABLE USING (NPI X TOTAL POPULATION) 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	1.6166	.5961	2.712	
LOGRCR	.9057	.0468	19.333	***
LOGUNE	.2618	.0294	8.906	***
LOGM	.0559	.0444	1.257	

F-Value = 354.341
Adjusted R-Square = .8386
***Significant at the 99% confidence level

Source: SAS Regression Output

TABLE 4.18

TOTAL ACCESSIONS AS THE DEPENDENT VARIABLE USING (PPP X TOTAL POPULATION) 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	2.0583	.4534	4.539	
LOGRCR	.9320	.0416	22.403	***
LOGUNE	.2622	.0299	8.746	***
LOGM	.0248	.0374	.662	

F-Value = 351.996
Adjusted R-Square = .8377
***Significant at the 99% confidence level

Source: SAS Regression Output

E. FORECASTING WITH PROPENSITY VARIABLES

Table 4.19 displays the results of enlistment forecasts for 1987. The forecasts were produced using coefficients estimated from the 1983-1986 net contract data set. Three model specifications are estimated. The first is simply the basic CNRC model. The second and third are the basic model with NPI or PPP included as propensity variables. Forecast enlistments from each specification are compared with known 1987 net contract totals and the percent error for each model is reported for each NRD. The percentage prediction of error does not differ greatly from specification to specification indicating that the addition of either NPI or PPP to this particular model has no great effect on forecasting accuracy.

TABLE 4.19

ENLISTMENT FORECAST PERCENT ERROR FOR 1987
BY NAVAL RECRUITING DISTRICT

Navy Recruiting Area/District	% Error No (No Propensity)	% Error (PPP)	% Error (NPI)
Area 1 New England			
Albany	-70.9	-69.2	-71.3
Boston	-39.7	-38.4	-41.3
Buffalo	-26.2	-24.3	-26.7
New York	-21.2	-21.3	-20.9
Philadelphia	-53.7	-52.5	-53.6
New Jersey	-26.8	-25.7	-25.5
Area 3 Southeast			
Montgomery	-10.4	-9.4	-10.9
Columbia	1.3	2.5	-.2
Jacksonville	18.6	19.5	17.6
Atlanta	-14.3	-14.1	-14.6
Nashville	3.2	4.0	1.1
Raleigh	-3.0	2.2	-3.3
Richmond	0.3	0.8	0.4
Miami	-12.6	-11.1	-14.3
Area 4 Northeast			
Harrisburg	-25.8	-24.9	-27.7
Washington D.C.	-4.4	-3.6	-5.0
Cleveland	-22.5	-21.7	-24.3
Columbus	-10.5	-10.4	-12.6
Pittsburgh	1.7	1.7	1.1
Michigan	-10.5	-9.9	-10.4

TABLE 4.19 (CONTINUED)

	% Error No (No Propensity)	% Error (PPP)	% Error (NPI)
Area 5 Midwest			
Glenview	4.1	3.7	4.2
St. Louis	-2.8	-2.4	-1.4
Louisville	5.2	5.3	6.0
Kansas City	18.4	18.5	18.7
Minneapolis	11.8	12.1	11.7
Omaha	-15.1	-15.4	-15.3
Indianapolis	10.2	9.1	10.1
Milwaukee	12.5	12.4	11.9
Area 7 Southwest			
Denver	19.9	19.7	20.2
Albuquerque	22.4	21.6	22.0
Dallas	14.3	13.0	14.2
Houston	4.3	4.2	3.2
Little Rock	14.5	13.7	14.7
New Orleans	17.5	16.3	17.7
San Antonio	-15.6	-15.9	-15.9
Memphis	7.8	7.0	7.5
Area 8 West			
Los Angeles	-9.1	-9.1	-9.6
Portland	10.7	11.1	10.6
San Francisco	-9.2	-8.9	-10.8
Seattle	15.7	14.7	15.5
San Diego	1.5	0.3	0.8

Source: SAS forecasting Output 1987

Examination of Table 4.19 does reveal significant regional diffferences in forecast accuracy. The model in all three specifications grossly overestimates enlistments in Area One (New England) while Area Four (Northwest) and

Area Seven (Southwest) are almost uniformly underestimated. In Areas Three, Five, and Eight the nature (over- or under-estimation) and the degree of forecast accuracy appear random. It is interesting to recall the propensity data reported in Tables 4.1-4.5 which indicated that Area One was the only Area in which Positive propensity levels were consistently below the national average throughout 1983-1987 while Areas Four and Seven displayed propensity well in excess of the average for the entire period.

The relationship between level of propensity and accuracy of forecasts seems to suggest more than mere coincidence. Regions like Area One which suffer from low levels of propensity are consistently overestimated and regions like Areas Four and Seven which enjoy high propensity levels are consistently underestimated. It seems that the inclusion of a propensity variable has no effect on the subsequent forecasting error. Somehow the apparent enlistment enthusiasm or lack of it in these regions causes a backlash effect in enlistment forecasting.

One potential candidate for use in explaining this situation is onboard recruiters. To a certain extent recruiter density within any recruiting Area or NRD for that matter is a function of CNRC's perception of the "richness" of the local youth market. Enlistment propensity is a component of that "market richness." Perhaps misreading the influence of propensity in the recruiter assignment process

is causing a less than optimal distribution in some recruiting Areas of recruiting assets, resulting in contract totals well above or below forecast levels. In any case the facts support the conclusion that the forecasting models do indeed suffer from a significant lack of precision in certain geographic areas. Knowledge of these weak spots is essential when it is considered that CNRC is forced to make policy decisions based, at least in part, on forecasts quite similar to those used in this study.

F. ANALYSIS OF PROPENSITY RESIDUALS

Table 4.20 displays the results of regressing the following model on the 1983-1987 net contract data set.

PPP = UNEMP + PAYRATIO + % URBAN + % MINORITY

TABLE 4.20

PROPENSITY RESIDUAL MODEL USING
PPP AS THE DEPENDENT VARIABLE 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	18.4943	2.1320	8.675	
UNEMP	.2891	.0435	6.643	***
PAYRATIO	.1504	1.4452	.104	
% URBAN	.3995	.6615	.604	
%MINORITY	-.6091	.7086	-.860	

F-Value = 12.238
Adjusted R-Square = .1806
***Significant at the 99% confidence level

Source: SAS Regression Output

The rationale behind this particular specification was to select socioeconomic variables which might well form the basis for explaining much of the variation in the positive Navy propensity measure. It should be noted that Table 4.20 indicates that the bulk of propensity is explained by local unemployment (the only statistically significant variable). An F-test conducted to test the null hypothesis that--Payratio, Urban, and Minority--are jointly equal to zero indicates that the null hypothesis cannot be rejected. It seems that these three explanatory variables selected with such care for their apparent relationship with propensity have little or no ability to its variation. The regression illustrated in Table 4.20 also generates the propensity residuals. These values represent that part of regional propensity not explained by the four variables in the previous specification,and which is thus assumed to represent an underlying "taste" for military service that is independent of economic conditions. The residuals calculated by NRD are added to the net contract data set.

Table 4.21 reports the results of regressing the basic CNRC model with Residual Propensity included as a linear explanatory variable. (The positive/negative nature of calculated residuals make it impossible to specify this variable as a Log.) The rest of the variables in the model are still in logs.

TABLE 4.21

RECRUITING COMMAND ENLISTMENT MODEL USING "RESIDUAL PROPENSITY" AS INDEPENDENT VARIABLE 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	2.0773	.4241	4.897	
LOGRCR	.8267	.0611	13.522	***
LOGUNE	.3072	.0332	9.232	***
LOGPOPA	.4213	.0398	10.582	***
LOGPOPB	-.3823	.0483	-7.903	***
RESID	-.0098	.0081	-1.205	

F-Value = 193.250
Adjusted R-Square = .8249
***Significant at the 99% confidence level

Source: SAS Regression Output

The results show only minor variation from the results reported earlier for the basic model with no propensity variable in Table 4.9. On the offhand possibility that the linear specification of the propensity residual variable might in some way bias the comparison, the entire model was reestimated with all variables in linear form and reported in Table 4.22.

Fortunately for this analysis the results displayed in the two tables are consistent with the contention that only minor differences separates the model specification with residual propensity from that without. An F-test was conducted to test the hypothesis that residual propensity is equal to zero for the model specifications reported in

TABLE 4.22

LINEAR SPECIFICATION OF RECRUITING COMMAND MODEL
USING RESIDUAL AS INDEPENDENT VARIABLE 1983-1987

Variable	Beta	Std Error	T Value	
INTERCEPT	-92.0417	47.3242	-1.945	
RECRS	7.3252	.5870	12.478	***
UNEMP	32.1482	3.9664	8.105	***
A-CELL POP	.0039	.0005	8.276	***
NON A-CELL POP	-.0025	.0003	-7.315	***
RESID	-7.3912	7.5746	-.976	

F-Value = 160.343
Adjusted R-Square = .7961
***Significant at the 99% confidence level

Source: SAS Regression Output

Tables 4.21 and 4.22. The results of that test indicate that the hypothesis cannot be rejected in either case. Examination of the remaining explanatory variables reveals once again the preeminence of onboard recruiters and the strong influence of "A" cell population and local unemployment on "A" cell contracts.

These results seem to indicate that NRD positive Navy propensity is primarily a function of local unemployment conditions. This leads to the conclusion that the use of positive propensity as an explanatory variable in any model which also contains a local unemployment variable is of questionable value.

V. CONCLUSIONS AND RECOMMENDATIONS

Expanding on the excellent background work by Huzar [Ref. 6] and the initial application study by Brose [Ref. 8] this study sought to continue to explore methods for using YATS II enlistment propensity data to produce significant explanatory variables which could be used to improve CNRC's enlistment forecasting models. In addition, the study addressed the relative merit of using net vice gross contract data for forecasting purposes.

The studiy's strengths are its ability to generate propensity measures at the NRD level based on weighted YATS data, to validate the superior applicability of net contract data to the enlistment prediction problem, and to establish the existence of a strong relationship between positive propensity and local unemployment. The study's primary weakness is the small sample sizes available for the calculation of propensity at the NRD level. Column N in Table 4.1 reveals that annual sample sizes vary from 31 to 299. Most are, however, well below 200. A recent study by Gorman and Mehay asserts that while YATS surveys are statistically reliable nationwide, their sample sizes are too small for direct development of local area propensity estimates. [Ref. 14:p. i] Their report concludes that a minimum sample size of approximately 200 is required to

reasonably estimate propensity at the local level. [Ref. 14:p. 16] This single condition may well account for much of the generally poor performance and lack of significance suffered by propensity-based explanatory variables in this study. Throughout the process of examination and comparison which characterized this study several salient points have become apparent, and they in turn lead to a series of recommendations both for future research and policy applications.

A. CONCLUSIONS

1. Weighted propensity should be the values of choice when using YATS II data to estimate propensity measures. Use of the data in any other form disregards the sampling technique used in the original collection of the data and may result in variables which misrepresent actual local propensity.

2. Net contract data should be the preferred form for use in forecasting enlistment. The advantages of added precision resulting from the recognition of DEP attrition cannot be ignored.

3. There has been a definite decrease in nationwide positive propensity during the period 1983-1987. This downtrend must be considered when selecting YATS II data for enlistment prediction. The results of this study suggest that the noted drop in propensity levels can be explained in large degree by the economic growth and particularly the declining levels of unemployment enjoyed by the national economy during this time period.

4. There is significant regional variation in the predictive accuracy of the current Navy enlistment model.

5. Residual analysis of positive propensity indicates that much of the variation in propensity is explained by other significant explanatory variables especially local unemployment. The degree to which other factors explain propensity reduces its effectiveness as an

explanatory variable in the enlistment forecasting models.

B. RECOMMENDATIONS

1. Analysis of the relation of YATS II stated enlistment intention to actual enlistment behavior should be actively pursued to see if there is a predictable relationship between stated intentions and actual enlistment behavior.

2. Investigation of additional YATS II questions with propensity implications should be initiated in an attempt to quantify more of actual enlistment propensity than that explained by the aided and unaided mention survey items.

3. Further investigation on the relationship between local unemployment and local enlistment propensity should be pursued.

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